L-Università ta' Malta
Faculty of Information & Communication Technology
Department of Artificial Intelligence

B.Sc. IT (Hons.) Artificial Intelligence

Integrating Saliency Ranking and Reinforcement Learning for Enhanced Object Detection

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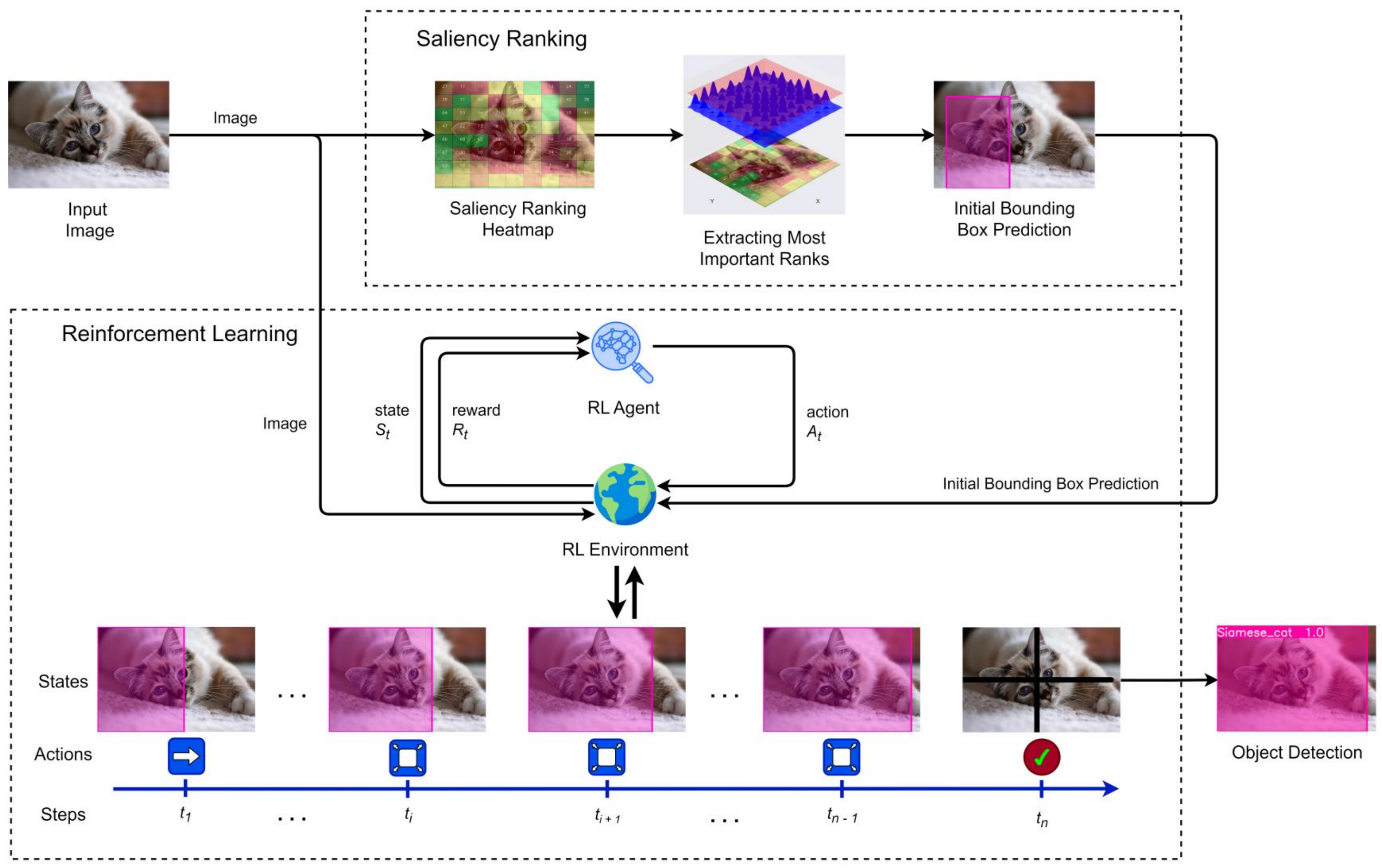
INTRODUCTION

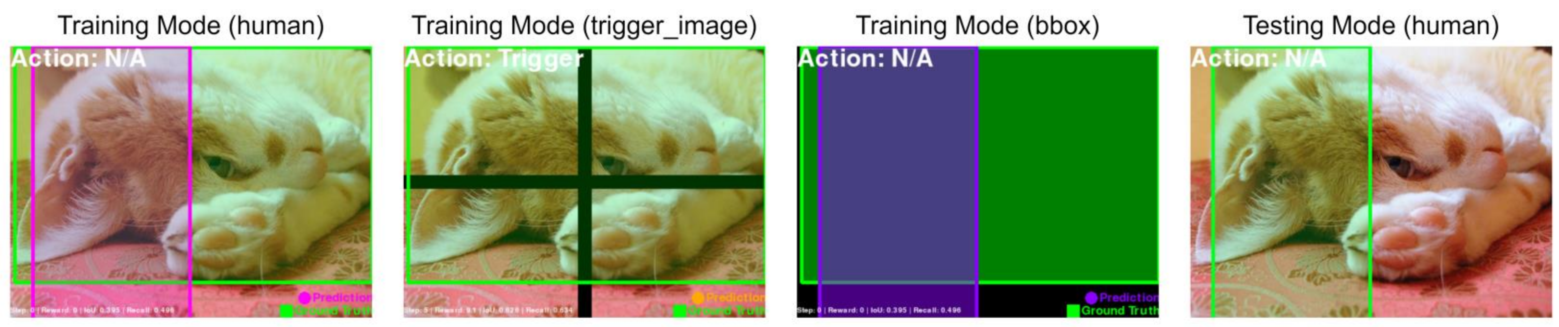
In an era where sustainability and transparency are paramount, the importance of effective object detection algorithms cannot be overstated. While these algorithms are notably fast, they lack transparency in their decision-making process. This study explores innovative approaches to object detection, combining reinforcement learning-based visual attention methods [1-2], with saliency ranking techniques [3], while providing necessary visualisations for explicit algorithm decision-making.

AIM

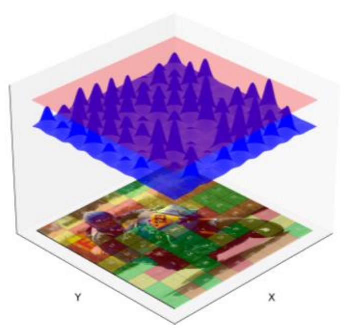
The objectives of this study encompass sourcing annotations from prominent object detection datasets such as COCO and Pascal VOC, evaluating existing RL-based object detector methodologies to develop a capable RL framework for object detection. Additionally, the framework will integrate saliency ranking to augment detection capabilities, emphasising visual attention. Real-time informative visualisations will be generated for observing the RL environment during training and testing, accompanied by action logs. Furthermore, diverse feature learning networks within the RL framework will be examined alongside various architectures of Deep Q-Networks to enhance object detection efficiency and accuracy.

ARCHITECTURE DESIGN

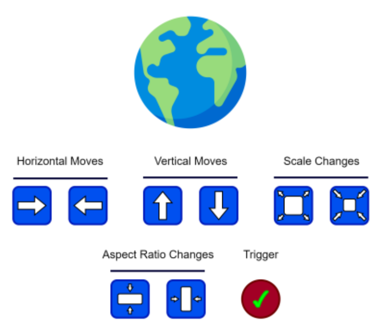




METHODOLOGY

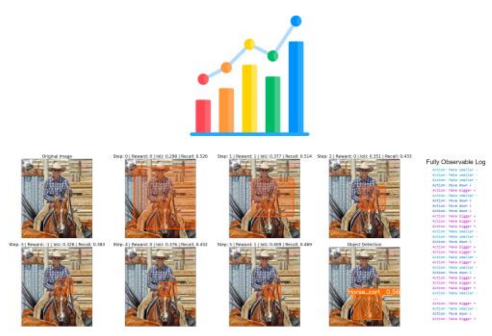


Configuring Saliency Ranking



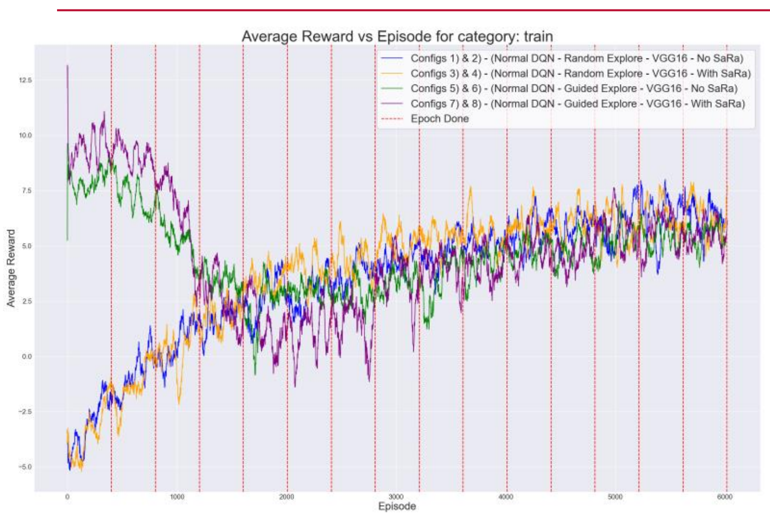
Environment Creation

Agent Training

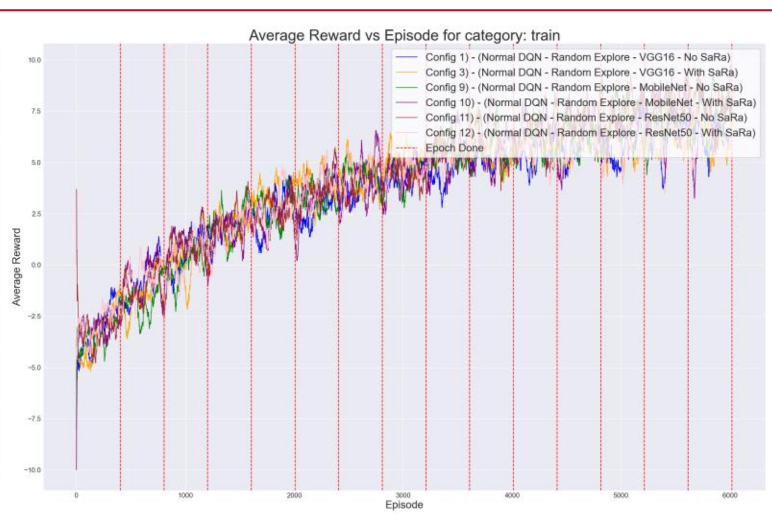


Evaluation

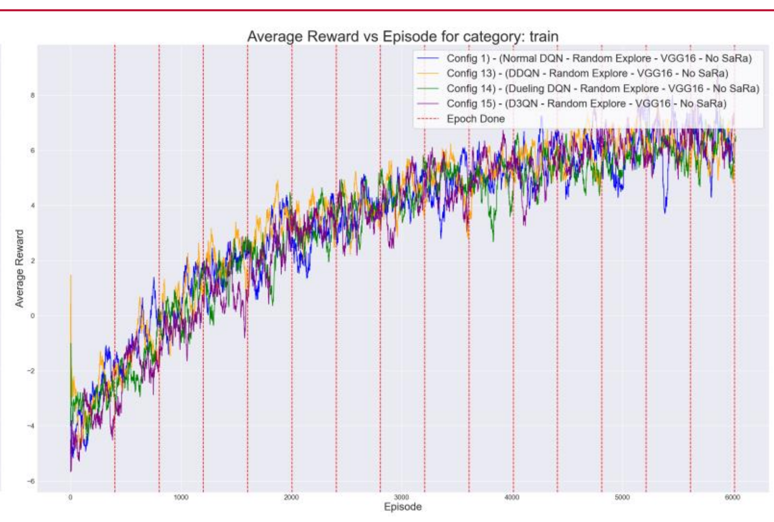
RESULTS



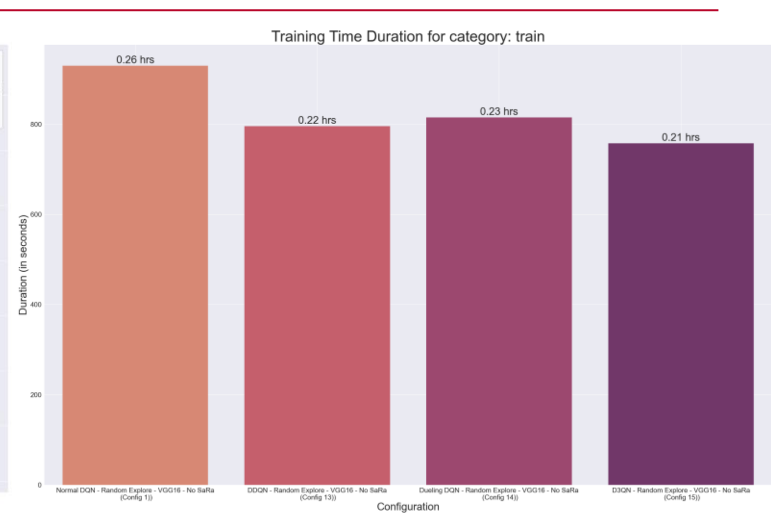
Average Reward vs Episode for category: train for Experiment 2.



Average Reward vs Episode for category: train for Experiment 3.



Average Reward vs Episode for category: train for Experiment 4.



Training Time for Experiment 4.

CONCLUSIONS AND FUTURE WORK

Ultimately, all predefined objectives of this project were successfully accomplished. A total of 15 agents were trained across diverse environment configurations, all exhibiting significantly improved performance compared to existing literature benchmarks. Notably, the developed system ensures self-explanatory operation, facilitating ease of understanding.

For future endeavors within this project, the integration of a continuous action space holds promise. Such integration would empower agents to precisely manipulate window movement in any direction, leveraging learned factors tailored to specific situations. Alternatively, the adoption of the Rainbow DQN algorithm for training and evaluation represents another avenue for potential advancement.

REFERENCES

1. J. C. Caicedo and S. Lazebnik, “Active object localization with deep reinforcement learning,” in Proceedings of the 2015 IEEE International Conference on Computer Vision (ICCV), ser. ICCV ’15, USA: IEEE Computer Society, 2015, pp. 2488–2496.

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3. D. Seychell and C. J. Debono, “Ranking regions of visual saliency in rgb-d content,” in 2018 International Conference on 3D Immersion (IC3D), 2018, pp. 1–8.